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Jury report
KHMW Kees Schouhamer Immink Dissertation Prize 2026

Dr. ir. T (Thom) Badings
Robust Verification of Stochastic Systems: Guarantees in the Presence of Uncertainty
Radboud University, September 2025

The Kees Schouhamer Immink Prize is assigned bi-annually and consists of 10.000 Euro for free usage. The award is provided by the Royal Holland Academy of Sciences (KHMW) in Haarlem, The Netherlands, for excellent research work in technical computer science/engineering and telecommunication in the broad sense with interesting societal applications. De KHMW jury has elected Dr. Thom Badings, at present postdoctoral research fellow at Oxford University in the United Kingdom and previously PhD researcher at Radboud University (Nijmegen), as winner of this award.

The central theme of Thom Badings' research is the improvement of the trustworthiness and safety of AI (artificial intelligence) systems where uncertainty and noise are inherently present in the input data and/or the system surroundings. The novelty of the work is that it combines Artificial Intelligence, Formal Verification and Control Theory, which are integrated into a unifying framework for safe and trustworthy decision-making while handling uncertainty in data and/or environments. This framework presents a structure that allows rigorous performance analysis of AI models with respect to trustworthy operation in complex situations. The thesis is of exceptionally high quality, since it bridges control theory mathematics and formal verification methods with practical AI system design and yet it is still very well readable and accessible to the generic technical reader. Also, findings and results are presented in a clear and visually very appealing way, which makes the work truly unique.

The thesis research contributes to four different areas. First, the work develops robust verification for continuous-state stochastic systems under uncertainty. Problems are solved via finite Markov decision process abstractions with interval-valued transitions. Second, the work delivers probabilistic verification for parametric Markov models, by developing new sampling-based algorithms that handle stochastic uncertainty of parameters without specific assumptions of the parameter distribution. The third part presents sensitivity-aware learning that enhances sample efficiency of data. This involves novel parametric models allowing efficient computation of sensitivity measures based on partial derivatives for performance metrics, leading to better learning. The fourth part discusses continuous-time Markov chains with uncertainty and improve them with verified inference. This research provides a robust verification framework for such Markov chains when the initial state must be inferred from noisy or incomplete observations.

Thom Badings' research is of the highest technical quality and its theoretical foundation is developed with high consistency and clarity which makes it highly accessible. Therefore, the work and the described relevant use cases have drawn significant attention in society. This is proven by national news coverage and live radio interviews. Besides this, the work is well covered by six distinct journal papers and a long list of premier international conference papers of very high quality. This includes two publications at the AAAI Conference, of which one was honored with a Distinguished Paper Award out of 9,250 submissions. Subsequently, an extension of this work was published as an article in the Journal of AI Research (JAIR) in a Special Issue on Award-Winning AI Papers, achieving a high citation score. Moreover, the publications list includes two publications in Computer-Aided Verification (CAV), the leading international conference on formal verification.

The PhD thesis of Thom Badings and the work were ranked with distinction (cum laude) and is already used as a textbook in specific research groups working on trustworthy AI and formal methods, which further emphasizes that the award is well deserved.

Prof. dr. ir. F.E. (Frank) van Vliet, hoogleraar microgolftechniek Universiteit Twente, principal scientist radar TNO
Prof. dr. ir. P.H.N (Peter) de With, hoogleraar Video Coding and Architectures (beeldbewerking) Technische Universiteit Eindhoven

The jury met online on December 15, 2026. The meeting was chaired by Dr. ir. Marc de Jong, societal member of KHMW. Also present at the meeting was Prof. A.P. (Ad) IJzerman, KHMW scientific secretary for STEM and medicine.